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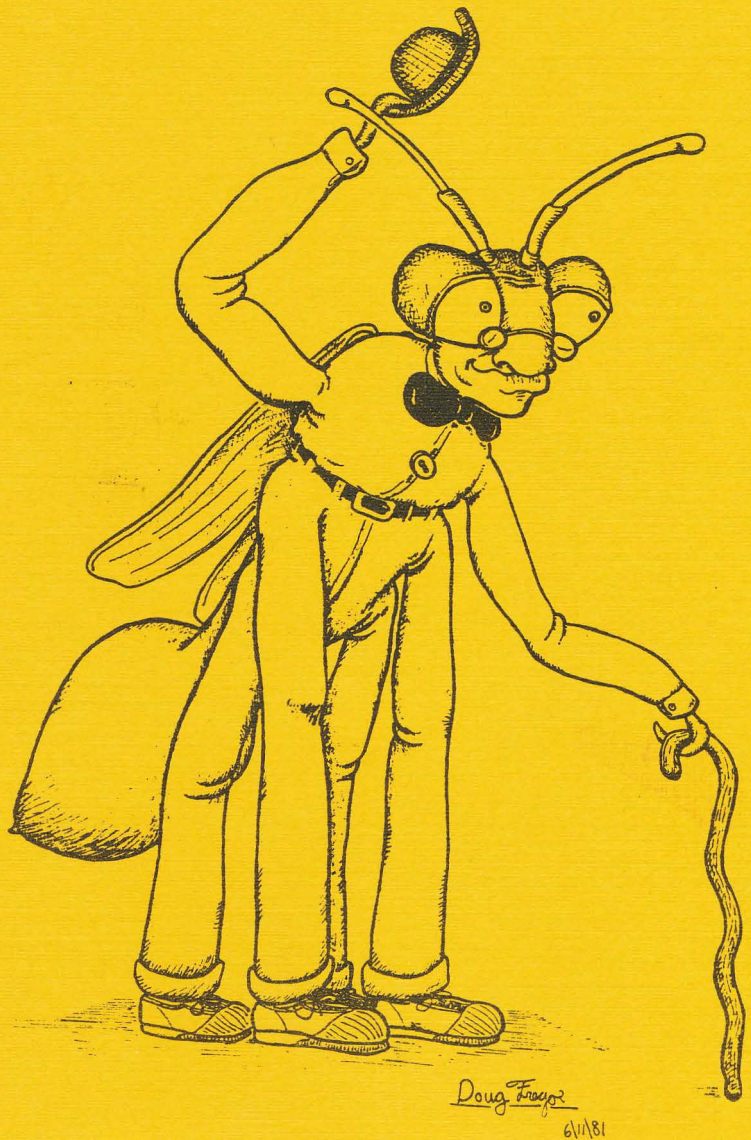

YOUNG ENTOMOLOGIST'S SOCIETY

COOPERATIVE EXTENSION SERVICE

MICHIGAN STATE UNIVERSITY • U.S. DEPARTMENT OF AGRICULTURE & COUNTIES COOPERATING

Y.E.S. QUARTERLY
Vol. 1 No. 2

INFORMATION FOR AUTHORS

Manuscripts and original artwork on any insect or Arthropod-related topic are welcome for publication in Y.E.S. QUARTERLY. Articles with special interest to young entomologists will receive publication priority. Manuscripts may be of any length, but should be double-spaced and typed (or neatly written). Photographs or maps should be done in black and white, and any drawings, charts, or graphs or maps should be done in black ink and should fit in the new page size. All authors should supply a title for their article and a complete mailing address. We're sorry, but no page proofs can be furnished.

Other features, including news, field notes, book reviews or other illustrations, are also accepted and will be used when space is available.

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Contents

THE PROBLEMS WITH REARING LEPIDOPTERA

David Albaugh
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I am sixteen years old and have been collecting and studying insects ever since I was seven. When I first started, I collected (only) butterflies. I can remember coming into the house with badly damaged Pieris rapae, which then were big catches. Only if I was lucky would I net a Danaus plexippus, and I was very lucky if I netted a Papilio glaucus or a Papilio troilus. Now, as my netting skills have increased and these butterflies are commonly caught in pristine conditions, my interests in entomology have broadened. What started out as a sole interest for butterflies increased to an interest in all Lepidoptera, Coleoptera, Orthoptera, and now Arachnida.

I can also remember my first rearing experience. I had just netted a male Danaus plexippus sipping nectar from a milkweed plant flower. After putting the specimen into a killing jar I looked up and saw a two-inch long caterpillar eating on the edge of a milkweed leaf. I carefully broke the leaf off and brought the caterpillar home. I put the caterpillar in a plastic container. I then found a jar and went back to the place where I found my first caterpillar. I checked as many milkweed plants as I could and managed to find four more larvae, which I thought was a significant amount. I picked three large milkweed plants and took them home. I put the five larvae and the plants into a box with a screen top. I looked through a butterfly field guide and identified them as larvae of Danaus plexippus. The next day, the five larvae were hanging from the wire mesh in a "J" position. Four of them were greenish in color with smudged-black lines. The fifth one was a blackish-brown and was stretched out hanging from the mesh. It was stretched out to about five inches. A possible result of malnutrition? Maybe a change in diet from fresh to cut food? Maybe the larva went up to hang before it was ready? This problem is very common; it happens both with rearing the larvae yourself and with ones found in the wild. Often on my collecting trips, I find larvae in the same condition hanging from foodplants.

Since then, I have been rearing D. plexippus larvae every year. Now I rear them in quantities of 200 to 500. I usually go out into the field and follow gravid females and collect the eggs as she lays them.

The second rearing experience of mine went perfectly. For Christmas I received what is known as "The Butterfly Garden." This is a box made of cardboard with cellophane sides, and

you get a coupon for a biological supply company, which sends you five first instar larvae of Vanessa cardui. These come in a small plastic container that has a green paste-like substance placed into the bottom of the container. This is the food plant evidently mashed into a paste.

The five larvae spend their entire life in the container until they pupate. After all five larvae have pupated, you fasten the top of the container with the five chrysalises to the top of the Butterfly Garden with some tape. In about a week, the chrysalises start to hatch and the adults to fly around in the box. Fastened inside the box is a cylinder-shaped roll of cotton that you moisten with an artificially made sugar solution that the adult butterflies feed on. After a few days, you let them go.

In August of 1980, my brother Stephen netted a gravid female Callosamia promethea for me. I put the moth into a plastic container originally designed to hold chameleons with a mesh screen top. Also in the container, I placed some sassafras leaves. The next day the moth was dead, but it had deposited twenty-one eggs. For some reason, only five of the eggs hatched. I reared the five larvae indoors on lilac that was placed in a jar filled with water. Two of the larvae walked down the stem of the lilac and into the water, drowning themselves. The third larva was attacked by a stink bug. What the stink bug does is pierce the larva's skin with its sharp mouthparts and sucks the larva dry. How this stink bug got into the house, I'll never know. The last two larvae pupated successfully and hatched into adults the following spring.

On Christmas Day, 1981, I received 12 Hyalophora cecropia cocoons, 12 Antheraea polyphemus cocoons, 12 Actias luna cocoons, 12 Callosamia promethea cocoons, 12 Automeris io cocoons, and 12 Philosamia cynthia cocoons. During the summer of 1982, the cocoons hatched. I made some cages out of cardboard boxes with the sides cut out and replaced with wire mesh screening. As the females hatched, I placed them into these cages and set them outdoors in hopes of attracting males. I only managed to attract one male Callosamia promethea. What a surprise I got when I walked outside and saw the male moth perched on the side of the cage. By the middle of the summer, I managed to successfully mate three pairs of Callosamia promethea and two pairs of Hyalophora cecropia.

In about a week and a half, the eggs began hatching. About 75 hatched every day. I reared some inside and some outside. Unfortunately, a big storm came and wiped out almost all the larvae outside. I took all of the cages and sleeves down. Some did survive though, because during the winter of 1983, I found 8

promethea cocoons. Unfortunately, all of the cecropia larvae were destroyed.

I had about a dozen larvae indoors--placed on lilac and kept high off the ground so that our cats wouldn't get at them. But the cats still did. The cats knocked over the container with the larvae and by the time I found out about six had apparently just walked away and three were crushed. The remaining three died two days later and were stretched out like the Danaus plexippus larva had been. A friend of mine said that the larvae were very susceptible to drafts at high altitudes due to the constant changing air flow. I plan on continuing the breeding and rearing of specimens for as long as I retain my interest in entomology. Hopefully, I will (soon) be able to overcome these unnecessary losses of larvae during rearing.

IDENTIFICATION OF NORTH AMERICAN TIGER BEETLES (COLEOPTERA: CICINDELIDAE)

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Even though the tiger beetles are one of the most intensely studied beetle groups, keys for the identifying the North American fauna are difficult to come by. Many of the available keys are useful only in certain regions or states, while others are in dire need of revision and updating. This article will be the first in a series of articles designed to provide keys and information for the identifying all North American and most Central American tiger beetle species and subspecies.

Eleven genera of tiger beetles occur in North and Central America. All of these genera, with the exception of Cicindela, are rather small (anywhere between one and ten species each) and more or less restricted in distribution. The genus Cicindela is quite large (contains almost 200 species) and is distributed throughout North and Central America.

The following key to the tiger beetle genera is adapted from Willis (1969).

A KEY TO THE TIGER BEETLE GENERA OF NORTH AND CENTRAL AMERICA (COLEOPTERA: CICINDELIDAE)

1. Metepisternum narrow, with groves anteriorly; mesepisternum strongly elongated; lacinia of maxilla without digitus (Collyrinae).....Ctenostoma Klug

   Metepisternum relatively broad, without anterior groove; mesepisternum usually short; lacinia with digitus 2

2. Anterior corners or pronotum more advanced than anterior margin of prosternum; 4th segment of maxillary palpus almost always shorter than 3rd.... (Megacephalini).....3

   Anterior corners of pronotum not more advanced than anterior margin of prosternum; 4th segment of maxillary palpus almost always longer than 3rd ....(Cicindelini).... 8

3. Palpiger of labial palpus reaching at most the mentum notch; elytra without humeral angles or markings.....4

   Palpiger of labial palpus clearly surpassing mentum notch (almost invariably very long); elytra with variously developed humeri, markings usually present.....5

4. Elytral epipleura punctate; front tarsi of male not dilated nor setose on underside ..... Amblychila Say

   Elytral epipleura impunctate; front tarsi of male dilated and setose on the underside .....Omus Eschscholtz

5. Lateral margins of elytra with stridulating organs; labrum long, with marginal setae.....6

   Elytra without stridulating organs; labrum often short, often with submarginal setae 7

6. Last tarsal segment normal, sparsely setose beneath; first three segments of anterior tarsi of male strongly widened

   Last tarsal segment thickened, densely setose beneath; first three segments of anterior tarsi of male scarcely widened ..... Chiloxia Guerin

7. Labrum mostly short and transverse, never with median tooth, almost always with submarginal setae; palpi mostly yellow; clypeus with lateral setae ....Megacephala Latreille

   Labrum long and narrow, with median tooth; with lateral setae; labrum and all appendages black; clypeus bald ..... Pseudoxychila Guerin

8. Head, pronotum, pro- and mesosternum, base of abdomen or base of elytra setose, OR posterior one-third of elytra with whitish sutural or discal markings ..... Cicindela L.

9. Epipleura of elytra and free lateral margin of hind coxae glabrous; middle of frons with at least one transverse impression; labrum without median tooth and with seven setae ..... Iresia Dejean

   Epipleura of elytra rarely setose; free lateral margin of hind coxae setose 10

10. Fifth tarsal segment of hind tarsu inserted on upper surface of 4th segment; mentum with a sensory seta on either side of median tooth ..... Oxygonia Mannerheim

    Fifth tarsal segment of hind tarsi inserted apically; mentum without setae on either side of median tooth; elytral epipleura glabrous ..... Odontochila Castelnau

Reference

Willis, H. 1969. Translation of Horn's key to the tiger beetle genera. Cicindela 1(3):1-15

A COLLECTING TIP

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Here's a tip for summertime collecting. I found that it really helps my collecting, so I thought I'd pass it along to you. I use an army-style web belt to carry my equipment. I attach the equipment by fastening an "S"-shaped link and key chain clip to the belt and a key ring to the equipment. For example, I bought two small draw-string bags and sewed on the metal key rings. I clip the bags to my belt and I use them to carry my collecting jars, envelopes and other equipment. I also attached a metal key ring to my net so I can clip it to my belt. This helps keep both of my hands free. If I see a butterfly, I can quickly unclip my net, or if I see a beetle or other insect on a flower, I can use both hands to catch it. Also, I can easily carry a canteen for those long, hot summer days.

LITTLE KNOWN INSECT ORDERS

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When one thinks of exotic insects, one usually is reminded of birdwing butterflies, orchid mantids, and rhinocerous beetles. While these insects are certainly exotic and unusual, the orders they belong to are well known. There are, however, entire orders of insects that are very little known. All of the following fascinating, but obscure, orders have representatives in the United States.

Grylloblattids

The grylloblattids are primitive insects related to cockroaches, they are sometimes included in the Orthoptera order. Other entomologists place them in an order all their own.

Grylloblattids are about half an inch long. Pale, wingless, and blind, they are found under rocks and logs. Unlike most insects, they are fond of cold environments, living at altitudes above 1500 feet. Their favorite haunts are ice caves and the edges of glaciers and snowfields. It has been said that the warmth of a human hand will kill them.

The range of grylloblattids is very limited, consisting of mountainous areas in the western United States, Canada, Japan, and the Soviet Union. In North America, they have been found in Banff National Park in Alberta, in California, and in Washington. They probably exist in similar habitats in other areas and only need to be discovered.

Embioptera

The Embioptera, also known as web-spinners, are another interesting yet obscure group. They are found in warmer climates living in silk-lined tunnels in the soil or under plant debris.

Web-spinners are small, dark insects. The males have two sets of similar wings, while the females are wingless. Their forelegs have structures for the production of silk. When disturbed they either play dead or run backwards.

Web-spinners are communal insects; many individuals often share the same nest. Females care for their eggs and young nymphs, but they are not true social insects like ants or termites.

Zorapterans

The Zorapterans are tiny insects usually found in dark places such as under bark, rocks, etc. There are fewer than two dozen species in the world, all belonging to the same genus.

Like the web-spinners, the Zorapterans live in a communal colony without actually being social insects. Within such a colony there are usually two forms, both having male and female sexes, and both capable of reproduction. The first form is dark-colored and winged. The second is pale, blind, and wingless. There is no known distinction between these forms as far as habitat or role in the colony. More needs to be known about this. Could this be a step in the evolution of a caste system such as termites have?

Strepsiptera

One of the most bizarre groups of insects is the Strepsiptera, or twisted-wing parasites. The males are strange-looking creatures with fan-shaped hind wings, reduced veins, club-like forewings, and a large head holding a pair of oddly branched antennae. The females are shapeless grubs, living out their lives within the body of a host insect.

Because their remarkable life cycle resembles that of certain blister beetles, they are thought to be related to the Coleoptera. Some entomologists go so far as to include the Strepsiptera in that group, considering them highly specialized beetles.

Strepsipterans develop by a process known as hypermetamorphosis. This is a form of complete metamorphosis involving two distinct larval forms. The first stage is called a triungulin. The triungulin is an active, six-legged form, more like a nymph than a larva. They are born alive and spend the first part of their life searching for a suitable host.

Once a host, usually a bee larva, is found, the triungulin enters the host's body and molts into a grub-like larva. The larva absorbs nutrients directly from the host's blood, as if it were just another organ. Female larvae usually do little damage to their hosts, but males often cause pronounced changes. When they damage the reproductive organs, the host often begins to exhibit changes such as opposite sexual traits and abnormal coloration.

The strepsipteran larva pupates inside its host, usually at the same time as the host. Males emerge from the host and spend their short lives searching for a mate. The female never leaves her host, living with only a portion of her body protruding. After mating and giving birth to thousands of triungulins, she dies.

The life cycle of the strepsiptera is as exotic as anything from the jungles of Borneo. The details of the grylloblattid and zorapteran life cycles are entomological mysteries just waiting to be uncovered. Tropical jungles don't have a monopoly on strange and little known insects. In fact, there are many things waiting to be discovered right in our own backyards.

RESEARCH CONTRIBUTIONS BY ENTOMOLOGISTS

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You don't have to be a professional entomologist at a university or other institution to contribute to our knowledge about the insect world. The following examples will hopefully give you some idea of what I mean.

If you are interested in Lepidoptera you may want to support the Lepidoptera Research Foundation. The Foundation was established by William Hovanitz in 1964 and managed by him until his untimely death in 1977. Bill started the Journal of Lepidoptera Research to encourage expanded research with Lepidoptera by providing an inexpensive outlet for both controversial and longer papers. The scientific merit of the journal is assured by an international board of eminent lepidopterists and each papers is evaluated by at least two scientists. The scientific benefit of the journal is its availability to researchers without page charges, free use of color plates, and reprints at less than cost. Membership in the Foundation includes a subscription to the quarterly Journal of Lepidoptera Research, a newsletter, discounts on Foundation literature, updated listing of all Lepidoptera or predominantly Lepidoptera societies and serial publications, and a knowledge that you are supporting an activity which is important and complementary to your interests and concerns with Lepidoptera. For further information or a membership application, contact the Lepidoptera Research Foundation, Inc. c/o Santa Barbara Museum of Natural History, 2559 Puesta Del Sol Road, Santa Barbara, CA 93105 USA.

In 1982 and 1983, four national scientific organizations and two regional ones passed or supported resolutions calling on the federal government to provide funds for a comprehensive biological survey of the United States. It is clear that state and

federal agencies dealing with agriculture, forestry, fisheries, wildlife and parks, as well as public, science, and conservation organizations, would benefit from such an important program. You can do two things to help the success of this proposed program. Write to your representatives encouraging their support for this program when it comes up for a vote. Then, if and when it is approved, all entomologists, amateur or professional, can make significant contributions to this study. We will keep you posted as the events develop.

Finally, you can make significant contributions simply by writing down your observations, faunal lists, studies, and keys to insect groups and submitting them to a journal (such as Y.E.S. QUARTERLY!) so that the information can be shared with the whole entomological and scientific community. No contribution is too small or too large.

BEETLE COLLECTING IN THE CAUCASUS MOUNTAIN RANGE, USSR

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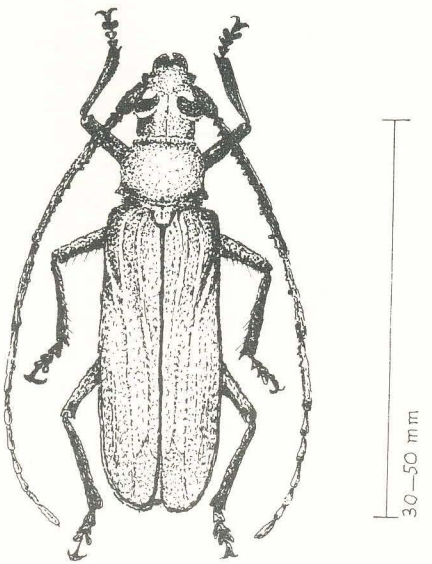
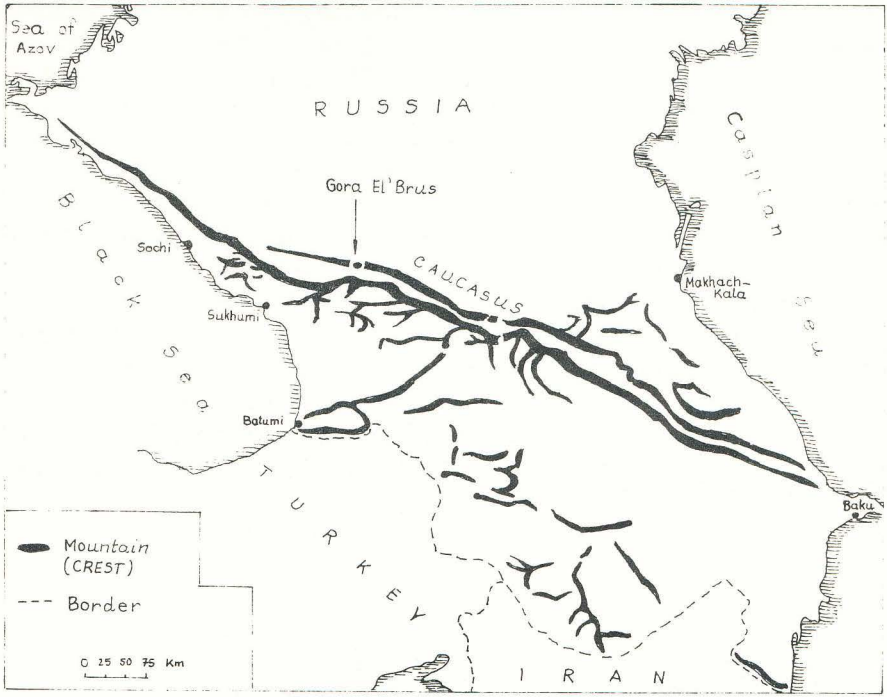
In May, 1982, I travelled to Russia to collect specimens of the genus Carabus and of the family Cerambycidae in the Caucasus Mountain Range. The Caucasus is situated between the Black Sea and the Caspian Sea. The highest mountain is Gora El'Brus (18,481 feet). Only a small area is accessible to foreigners.



Megopis scabricornis Scop. ♂

I chose the city Sochi, called the "Pearl of the Black Sea," in the Soviet Socialist Republic of Krasnodarskij. In earlier times this nearly one hundred-mile long city was used as a health resort by the czars. Today it is regularly visited by major Soviet politicians, who spend their vacation in this beautiful landscape and its very pleasant climate.


Sea of Azov
RUSSIA
Caspian Sea
Gora El'Brus
Black Sea
Sochi
CAUCASUS
Makhach-Kala
Sukhumi
Batumi
TURKEY
Baku
IRAN
Mountain (CREST)
Border
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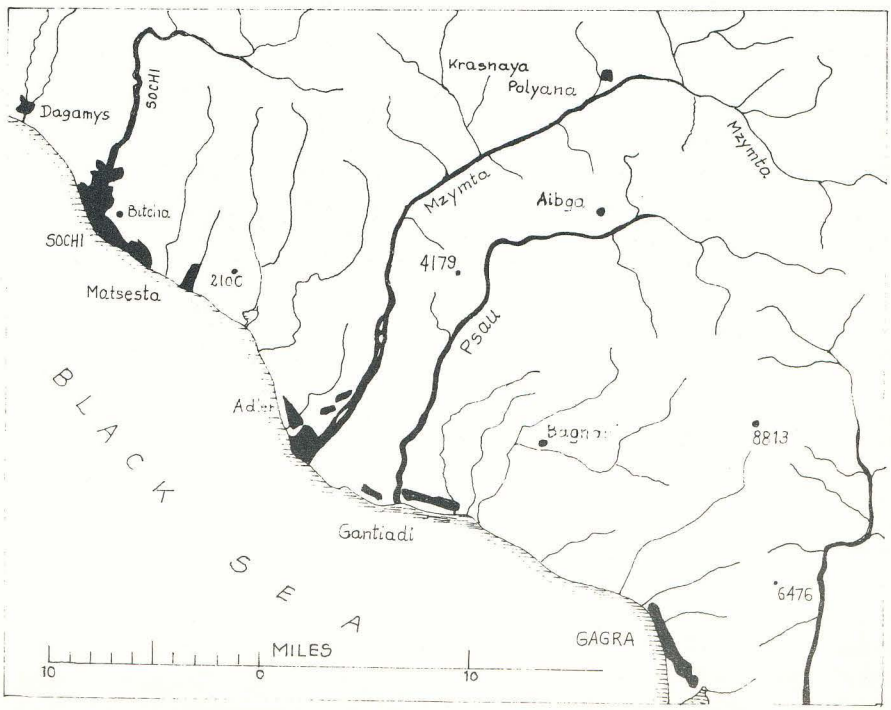
Krasnaya Polyana
Dagamys
SOCHI
Mzymta
Mzymta
Aibga
Adler
SOCHI
Matsesta
2100
4179
Psau
BLACK SEA
8813
Gantiadi
6476
GAGRA
MILES
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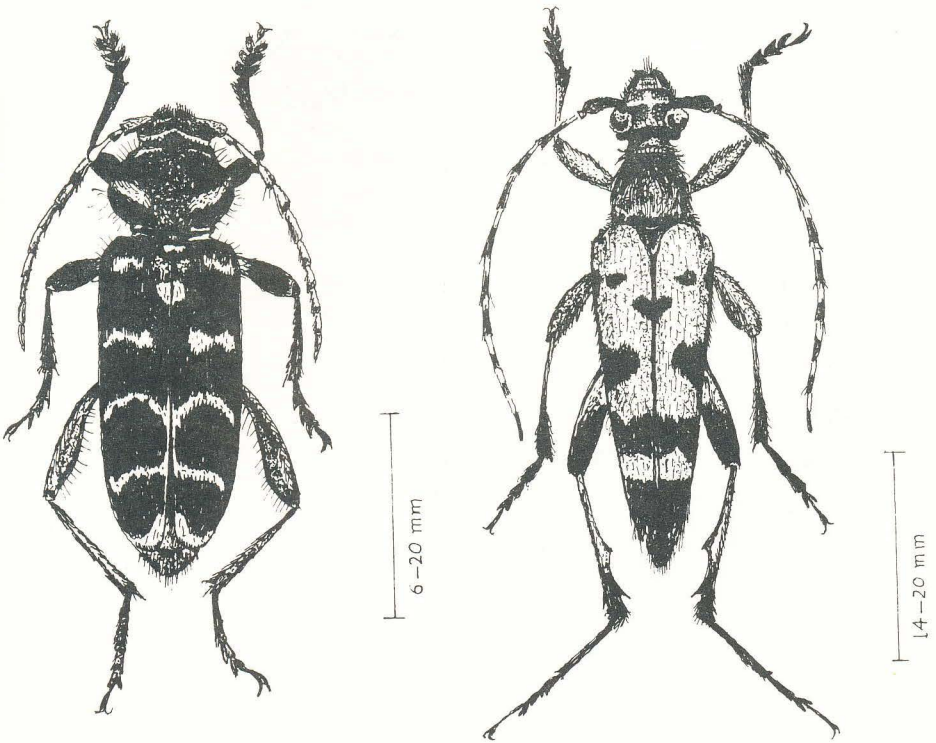
From a Czechoslovakian entomologist, a close friend of mine, I received a hand-drawn map on which he had marked the best collecting locations. Northeast, not far from the city, is a small village with an old windmill on top of the mountain called Bitcha. In a primeval forest of huge, ancient oaks and beeches, I set the first of a dozen ethylene glycole traps. I was very impressed with this forest, bathed in light, and full of ivy-covered trees and yellow blossoming Rhododendron shrubs. About the time the oak trees reach their maximum age, they begin to fall one by one and open large windows in the canopy of the tree tops. Naturally, these glades were perfect for collecting Cerambycidae. I captured such species as Rhagium fasciculatum Fald., Strangalia maculata Poda, Megopis-scabricornis Scop., Mesosa nebulosa F. and Morimus verecundus Fald. Some days later, I checked the traps and found Carabus-(Megodontus) septemcarinatus Motsch., a large, black ground beetle with blue bordered elytra.



Plagionotus arcuatus L. ♂ *Strangalia maculata* PODA ♂

Some miles south of Sochi is the town of Matsesta. There I found a completely different forest, full of shady slopes and humid gorges covered with Tilia, Castanea, Carpinus, and sometimes Abies, as well as dense impenetrable bushes of

Rhododendron ponticum and Vaccinium arctostaphylos. I spread some traps there and caught Carabus (Archiplectes) reitteri achumensis Gottw.

Since I was enthusiastic to go deeper into the Caucasus, I decided to go by helicopter to Krasnaya Polyana. This nearly one-hour flight took me over the lime green deciduous forest up to a dark coniferous forest. And higher up even this belt became lighter. Delicate, brushstroke-like streams were meandering down from glacial snow blankets. What a tremendous contrast!

After landing in the valley, I collected the following long-horned beetles in an almost pure forest of chestnut: Morimus verecundus Fald., Plagionotus arcuatus L., Plagionotus floralis Pallas, Strangalia maculata Poda, Cerambyx scopolii Fuessl, and Chlorophorus varius Mull. Afterwards I had the great pleasure to be invited to a typical Caucasian dinner, which consisted of olive green caviar, Kebabs, butter and solid dark bread, bacon, garlic, onions, gherkin, and streams of red Caucasian wine and vodka. The accompanying toasts were full of cryptic humor.

My last trip brought me to Abchazskaja in the Soviet Socialist Republic of Gruzinskaja, where I visited the city of Gagra. This area was well known to the ancient Greeks. It is the famous Kolchis where the legend of the "Golden Fleece" originated. In the woods around this city, I found Carabus (Pachycarabus) koenigi Gnglb., a beautiful, light blue beetle under some downed trees.

As on other occasions, I had some trouble with officials at the airport. After a long discussion in which I, meek as a lamb, explained the purpose of my visit, I was finally allowed to leave with my specimens, including living larvae. Of course, I was the last to board the plane. I certainly hope that I have the opportunity to visit this most interesting area again!

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Plavil'scikov 1958. Fauna SSSR, Tom XXIII, Moskau/Leningrad.

CECROPIAS IN MY SCREEN PORCH

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I would like to relate a unique night I spent collecting the cecropia moth a couple of years ago. (By the way, this method has worked great every year since.)

It was a night during the first week of June, and I had to attend a wedding. A fine, female cecropia moth had emerged a day before in one of my rearing cages. I have in my yard an attached porch with large doorwalls and screens. When I left that night, with I left of the doorwalls open and closed the screens.

About midnight, a dense fog rolled in, (I live near Lake St. Clair, MI) and the humidity was really high. I arrived home about 2:00 A.M. I forgot I had left the moth loose on the porch. I heard something beating against a tulip tree next to the porch. When I flipped on the yard light, I was pleasantly surprised to find three cecropia males walking on the screens. There were others flying up in the trees. In the next few hours until dawn, I admitted seventeen male cecropias onto my porch. Everytime one wanted in, I simply opened a sliding door and in he came. I had hoped that the female would mate with the largest male, but instead she picked a much smaller one. I released all the moths but two, which I saved for a collection. I took photos of the whole process, plus the hatching of the eggs that followed a short time later.

I have found this method to work very well ever since, but not as productive as that first night. I really find staying up all night to see how many show up very interesting.

LADYBUGS & YOU

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Everybody knows that you can tell how old a ladybug is by counting the spots on its back. . . . Right? And we all smile

when we see one of these M&M-colored beetles perambulating fearlessly across a leaf--or on our hand. Their placid character seems to protect them from our normal "squash instinct" for other bugs. Which is good. Because, not only are ladybugs cute little fellers, but they wear the white hats in the insect world--because they eat pest insects.

They got their name, legend has it, in the Middle Ages, when a cult of the Virgin Mary dedicated these beneficial insects to the Virgin. They called them the "Beetles of Our Lady." During insect infestations, the ladybug was always there to save the day--in answer to prayers for Our Lady's help.

Wherever they got their start, ladybugs, also called ladybird beetles and lady beetles, are probably the best known of the beneficial insects. Ladybugs belong to the family Coccinellidae, which means little sphere. They are found all over the world and come in assorted sizes, colors, and spots: red, tan, orange, brown, metallic blue, yellow, and black, with 22, 15, 13, 9, 2, and no spots--and everything in between, including racing stripes and hair.

North America has over 350 species (a category of biological classification of related organisms or populations) of ladybugs. Ladybugs are holometabolous--they go through a complete metamorphosis (like butterflies): egg, larva, pupa, and adult. The life cycle is relatively short, about 20 to 35 days from the time eggs are laid to when the ladybug becomes an adult.

Eggs are laid in clusters on the undersides of leaves or in the crevices of bark. For the more common ladybug species, the eggs are yellow or orange, oval or spindle-shaped and laid on end. Larvae hatch within days and immediately start looking for food. Food is easy to find, because most ladybugs lay their eggs near or in the middle of a food supply, like a colony of aphids.

Ladybug larvae are ugly creatures, rather like tiny alligators--in looks and personality. They have six long legs, are flat and dark-colored, with orange, blue, and black patches of color. Their body is deeply segmented, tapered toward the end, and covered with bristles.

Ladybugs will never be accused of having anorexia nervosa--they eat all the time. Most larvae eat from 200 to 500 aphids in their short life, usually by biting a hole in the body wall of their prey and sucking out the body fluids.

The larva molts three or four times before becoming a pupa. When ready, they glue themselves, by their tail, to a leaf or branch. They do not enclose themselves in a cocoon. Pupae vary in color from black to black and red, and they look like horseshoe crabs. Although they cannot move, they will twitch if disturbed.

After three to ten days, the adult ladybug emerges (around early May). Ladybugs never get very big, ranging from the size of a pinhead to the size of a little fingernail. They have wings and fly to different locations searching for food. They mate one to two days after emerging and begin laying eggs seven to ten days later.

Ladybugs are a prolific species. Some have been recorded as laying 1,550 eggs in two months! The normal rate, however, is ten to twelve eggs per day for two or three months.

The appetite of adult ladybugs is hearty. Certain species have been known to munch around 250 aphids a day, though most eat around 50 aphids (also known as plant lice) a day.

With their pleasant character, you would think that ladybugs would have no enemies. But some animals do attack them. Some species of ants herd aphids to feed on the honeydew made by the aphids. When ladybugs trundle in to eat these aphids, the ants attack. Fortunately, ladybugs have a line of defense. When attacked, they exude blood from their leg joints. The blood stinks worse than a skunk, is sticky and traps enemies, like ants. Also, when ladybugs are disturbed, they rise to a vertical position and then slowly drop back--sort of like feigning death.

Their bright, contrasting colors warn predators, like birds, that they don't taste good; therefore, most predators avoid them. Enemies to which they have little defense are parasites and pathogens, although death to ladybugs by these insects is minimal.

In temperate climates, like Michigan, ladybugs go through one or two generations each season. Even if the weather favors them having more generations, their biological system is tuned to the availability of their food source. If it isn't around, neither are they.

Ladybugs usually begin hibernating in early to late fall. They pass the winter in large or small aggregations, or singly, in sheltered places like tree holes and hollow stumps, beneath stones, and in piles of rubbish. They may even hibernate in the wall spaces of houses. In Michigan, some ladybugs hibernate in large colonies, usually around the lake shores. In the mountain valleys of California, some ladybugs hibernate in such huge numbers that fifty to sixty gallons of beetles are often collected in one spot (one gallon holds 135,000 beetles).

And why would anyone want to collect these cheerful, rotund creatures?

To put them to work in the fields, of course.

The ladybug's diet consists of more than mere aphids (insect pests that suck the sap from plants). Included on their menu are asparagus beetle eggs, Colorado potato beetles, grape

rootworms, bean thrips, alfalfa weevils, and chinch bugs. But their specialties are aphids, scale insects, mealybugs, whiteflies, and spider mites.

And with their insatiable appetites, the more food walking around, the more they eat.

The fame of ladybugs being beneficial insects began in 1888 when these beetles virtually rescued the California citrus industry from destruction by the cottony cushion scale. The vedalia beetle, Rodolia cardinalis, was the particular heroine, and it was imported from Australia. Cottony cushion scale is a small insect that attaches itself to the leaves and twigs of citrus trees and sucks out the sap. It, too, had come from Australia.

The vedalia beetle so successfully controlled cottony cushion scale that it was never a problem again. That is, until DDT and subsequent pesticides came along. These insecticides killed the ladybug and all other beneficial insects along with the pest insects. Unfortunately, the pests came back quicker than the beneficials and became resistant to the pesticides, unlike the beneficials. This lead to destructive outbreaks of cottony cushion scale that hadn't been seen for fifty years. Eventually, colonies of the vedalia beetle were reestablished and the cottony cushion scale was once more under control.

Other imported ladybug successes have succeeded the vedalia. For example, a ladybug that preyed on mealybugs was brought in from Australia in 1891 to control citrus mealybugs. This ladybug, Cryptolaemus montrouzieri (better known as the mealy bug destroyer), was the first outstanding example of mass production of a beneficial insect for biological control, as opposed to chemical control. The ladybug had to be mass reared because it could not survive the winters in California's interior valleys. By mass rearing them, ladybugs could immediately be put to work in citrus groves whenever mealybugs became a problem.

Other ladybugs have been imported from other countries to control scale and mealybug pests in California, Florida, and Louisiana. But ladybugs don't have to be imported from other countries to be effective. The ladybugs common to North America do the job just fine. It's only when insects manage to come in from other countries and then become pests in our country do we possibly need to import beneficial insects to control the pest. For instance, the convergent ladybug, Hippodamia convergens, is native to North America and is well known for controlling aphids. In fact, much of the time, we never even notice beneficial insects at work.

Home gardeners and organic farmers have long known about the benefits of ladybugs. The main problem they have is keeping the ladybugs in their garden and keeping them alive.

There are some tips to keep in mind. When ordering ladybugs, make sure they are fed a special diet before they are shipped. The diet insures that when the ladybugs arrive, they will be ready to lay eggs.

Don't put ladybugs in a garden or field too early in the season. If there aren't enough pests to keep them alive, they will either fly away to a more favorable location or they'll starve to death. What you can do, is put part of the ladybugs in your garden to control what pests are there, and store the rest in your refrigerator--not the freezer. Although this sounds cruel, the ladybugs really don't mind. They'll just hibernate until you take them out--no longer than a few weeks.

The best time to release them is at sundown or late afternoon. Sundown is best, though, because ladybugs are more apt to stay in the garden overnight and look for food in the morning. The ground should be moist and cool. Dampening the ground in the areas where you plan on introducing the beetles is a good practice. A good mulch also gives the ladybugs a place to hide during the night.

When putting them out, gently place handfuls of them at the base of plants, about 20 to 30 paces apart. Rough handling will excite them and they may fly away. Placing them at the base of plants insures that they will stick around for awhile, because their first instinct is to climb the nearest plant and look for food.

If the weather is warm and sunny, the ladybugs may start laying eggs in a couple of days, which means in about 15 days the alligator-like larvae will be chomping pests. And laying eggs is the key to keeping ladybug populations, rather than buying bunches of them and dishing them out like Reese's Pieces. For ladybugs to always be around, they must lay eggs. For them to lay eggs, there must be food. For food to be available, the environment must not be sterilized by pesticides.

Simply introducing ladybugs into an environment is not a cure-all. If you don't have ladybugs in your garden now, there is probably a reason for it--the environment probably isn't attractive or suitable for ladybugs to survive. Introducing ladybugs into this type of environment will not solve the problem, as they will fly to greener pastures or die. Even if your garden for field is amenable to ladybugs, if you put them out in quantities, most of them will probably fly someplace else. They will balance themselves out according to the food supply.

Also, ladybugs aren't miracle workers. They don't kill all pests. Remember, aphids, scale, mealybugs, spider mites, and whiteflies are their specialties.

Home gardeners should be especially careful of any insecticides they use, because chemical insecticides can poison lady-

bugs. Contact and broad spectrum (toxic to a variety of insects) insecticides will kill ladybug larvae and adults. Systemic and selective insecticides are less toxic to ladybugs, especially if applied in the soil. Bacillus thuringiensis, a microbial insecticide, available in hardware stores under the trade names Dipel and Thuricide, is especially good at controlling foliage-feeding caterpillars--and it does not harm the enviroment.

In orchards, ladybugs are driven into the trees when ground cover is destroyed. Defoliants on peach trees in late summer concentrate aphids on the remaining foliage where they become easy prey for predators like ladybugs. Strip farming of alfalfa maintains a population of beneficial insects at all times. Having a pollen or nectar food source nearby is especially useful in keeping populations of ladybugs and other beneficial insects in the area when their essential food supply is missing or diminished. Alternative food sources can be used to attract these beneficial critters, too.

And all ladybugs are beneficial predators--except for a couple black sheep: the Mexican bean beetle and the squash beetle. The Mexican bean beetle feeds on bean foliage, while the squash beetle feeds on foliage of pumpkin, squash, and related plants.

Fortunately, of these pest ladybugs, the Mexican bean beetle is the only one found in Michigan--and other ladybugs attack it.

INTERSPECIFIC REPRODUCTIVE ISOLATION IN TWO RELATED SPECIES OF FLORIDA TIGER BEETLES (COLEOPTERA: CICINDELIDAE)

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A recent investigation of the tiger beetle fauna of Florida revealed some interesting questions concerning the distributions and ecologies of the closely related species Cicindela marginata Fabricius and Cicindela hamata (ssp. lacerata Chaudoir). These two species appear to have identical ecologies, are nearly morphologically identical (in areas where they are taken together they can be easily misidentified if not examined carefully), and are active at the same time of the year.

Cicindela marginata is a monotypic species that inhabits coastal areas. Adult beetles are commonly taken on mudflats, muddy beaches, and occasionally on the upper regions of coarse, sandy beaches. The range includes the Atlantic coast of the United States from southern Maine south to Florida, portions of the Bahama Island group (Bimini, Exuma) and Cuba (Figure 1). Populations at the northern end of the range (New England) are highly variable in color, ranging from dark, grass-green to brown to nearly black. Populations in Florida are less variable and are usually greenish-brown or brown.

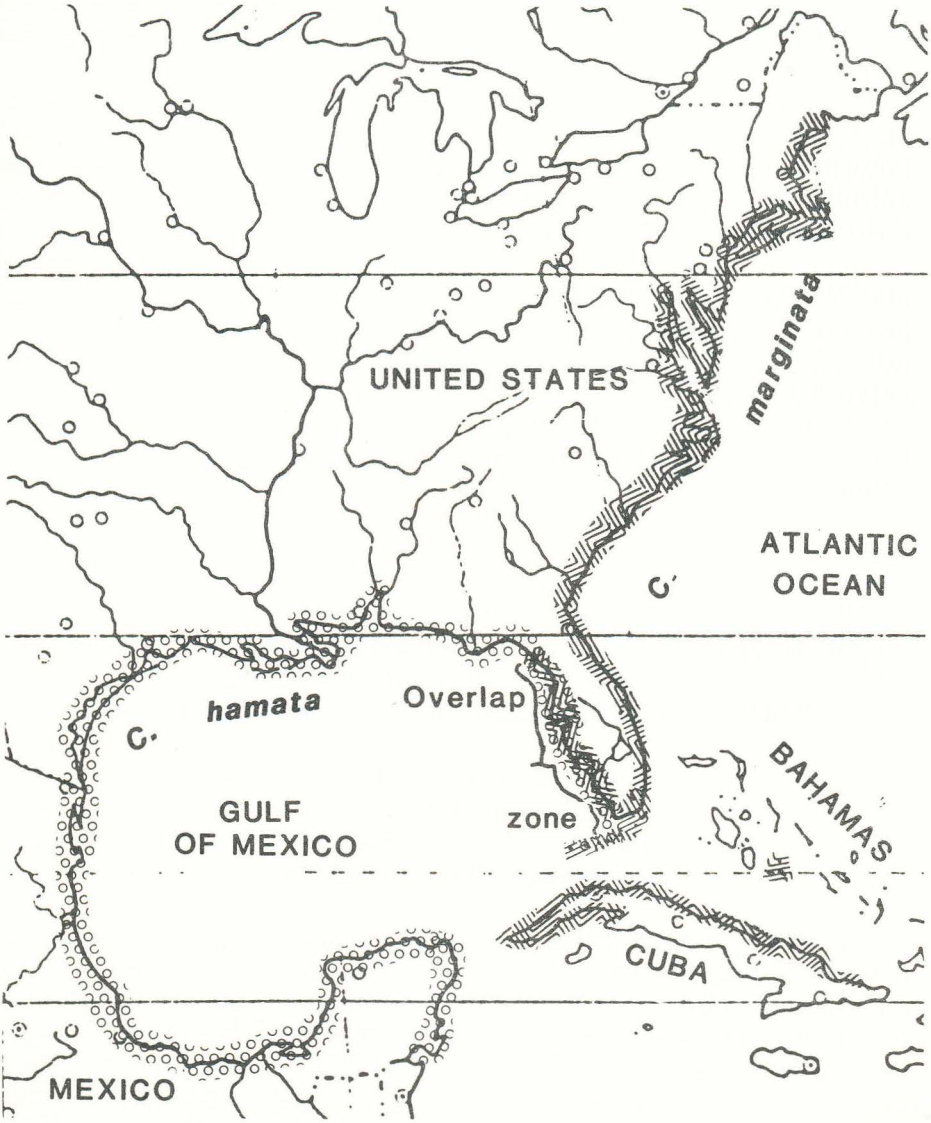

Figure 1. Distributions of Cicindela marginata F. and Cicindela hamata Aud. and Brulle. Note the area of overlapping populations along the west coast of Florida and in the Florida Keys.

Cicindela hamata is a polytypic species that also inhabits coastal areas. Adults are encountered on mudflats, muddy beaches, and coarse, sandy beaches. The range includes the Gulf of Mexico coast, including western Florida, Alabama, Mississippi, Louisiana, Texas, and Mexico (from Tamaulipas to Quintana Roo) (Figure 1). The species hamata is represented by four subspecies, which vary principally in size, color, and degree of maculation. The nominate subspecies, C. h. hamata Audouin and Brulle, is known only from Veracruz, Mexico. The elytra are greenish with narrow, white maculation. The overall body is smaller than the other subspecies. C. h. monti Vaurie is also greenish (occasionally brownish), but differs with its broader, more complex elytral maculation and larger size (11 to 14 mm). It occurs from Tamaulipas, Mexico and southern Texas to Mississippi. C. h. lacerata has a brownish elytral color, although Florida populations are somewhat variable in this respect with reddish, bluish, blackish, and green individuals

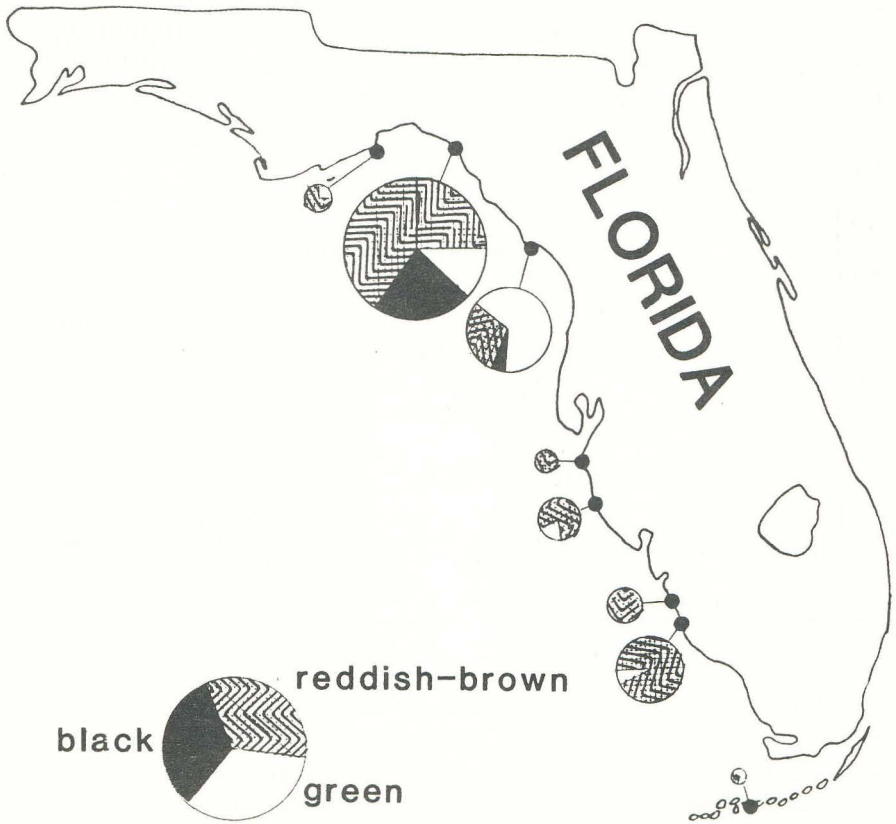

Figure 2. Elytral color in Florida populations of Cicindela hamata lacerata Chd. Size of disc indicates relative size of population sample.

(Figure 2), and is distributed from Alabama to the tip of the Florida peninsula (including the Florida Keys). The fourth subspecies, C. h. pallifera Chaudoir, has greatly expanded white, confluent maculation with the remaining area cupreous-red. It occurs along the beaches of the Yucatan Peninsula from Quintana Roo to Tabasco, Mexico.

The distributions of these species were first thought to be completely allopatric, with C. marginata restricted to the Atlantic coast, Bahamas, and Cuba, and C. hamata restricted to the Gulf of Mexico coast. However, a small area of overlap in the area near the extreme southern tip of Florida and the Keys was known to exist. Recent investigations by the author and Paul Choate of Gainesville, FL, have shown that the area of overlap is much larger than was ever imagined--approximately 325 miles of Gulf coast from the Florida Keys north to Citrus Co., FL. This extensive overlap raises a question about the existence of a reproductive isolation mechanism. Despite their common ancestry, morphological similarity (there are no constant differences in size, markings, pilosity, etc.), and ecological similarities, no hybrids have ever been found, so there must be some effective barrier to interbreeding.

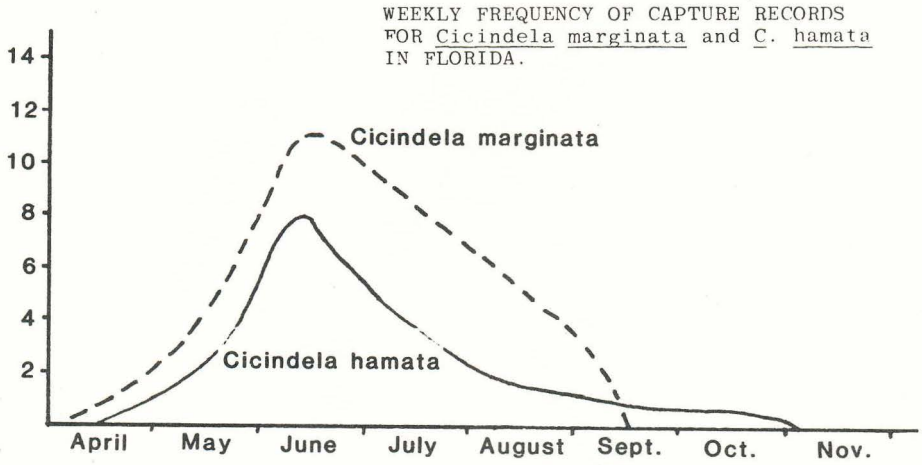

Figure 3. Graphic presentation of adult seasonal activity periods for Cicindela marginata F. and Cicindela hamata lacerata Chd. based upon a summary of available collection records.

As previously mentioned, there appears to be no temporal, spatial, ecological, or behavioral isolation mechanism. The seasonal activity periods are nearly identical for the two species (Figure 3). Both species have a single continuous period of adult activity during the spring and summer months (variable according to locality). Where the ranges overlap (Figure 1), both species are commonly taken from the same habitat. The habitat requirements are not significantly different for either the larvae or adults. Behaviorally, both species have diurnal

activity periods. Incidentally, both species are marginally active at night and frequently fly to lights.

The effective isolation mechanism seems to center around a non-genetalic mating structure. As it turns out, some of the structures involved in this mechanism have been recognized and used as taxonomic characters, but the role in isolating the two species has not been emphasized. Freitag (1974) showed that the mandibles of the male and a mesepisternal "coupling sulcus" of some female tiger beetles act as a mechanism to enhance mating success. This secondary, non-genetalic mating mechanism has evolved such that it undoubtedly prohibits females (and also between conspecific males).

The right mandible of Cicindela marginata has a broad, blunt tooth on the underside immediately anterior to the mandibular teeth. The mandible has an angular (though obtuse) bend midway between the base and apex. The female's mesepisternal coupling sulcus consists of a short, shallow groove. In addition, the tips of the elytra are depressed. The right mandible of Cicindela hamata has only an inconspicuous bump on the underside near the angular bend. The female's mesepisternal coupling sulcus consists of a deep cavity near the posterior margin. The elytral tips are not depressed, but the elytral spines overlap horizontally.

The mandibular tooth of the male marginata is well suited to the broad, shallow groove of the female's coupling sulcus. Similarly, the toothless, more cylindrical mandible of the male hamata is well suited to the deep cavities of the female's coupling sulcus. Conversely, the lack of "fit" between the structure of non-conspecific male and female individuals would prohibit or discourage successful interspecific copulation, thereby establishing an effective non-genetalic isolation mechanism.

Freitag (1974) concluded that the "groove-type" coupling sulcus is more primitive (occurs most commonly among the phylogenetically primitive groups) than the "cavity-type" coupling sulcus (which occurs most commonly among the phylogenetically advanced species). Natural selection for these character states is a result of behavior induced by indirect environmental influences. Generally speaking, the more advanced species are adapted to warm climates (central and southern U.S., and Mexico) and the acquisition of these cavities is an obvious advantage to mating where males are required to grapple with agile, rapidly-moving females. Conversely, the primitive species are cool-adapted (northern U.S. and Canada) and the cavity-type coupling sulcus offers no advantage over the more primitive groove.

Both marginata and hamata belong to the Ellipsoptera ("subgeneric") group of North American tiger beetles. Other species belonging to this group include C. blanda Dejean, C. wapleri LeConte, C. nevadica LeConte, C. sperata LeConte, C. marutha Dow, C. cuprascens LeConte, C. puritana G. Horn, C. lepida Dejean, C. gratiosa Guerin and C. hirtilabris LeConte. Of this group, marginata and blanda have poorly developed, shallow grooves for coupling sulci, while lepida and marutha have deep grooves. The remaining species have deep cavities. Thus, it would appear that marginata, blanda, lepida, and marutha are possibly older, more primitive species and have sustained little or no selective pressure for developing a cavity-type coupling sulcus.

Unfortunately, we don't know very much about the ancestry of modern-day tiger beetle species because of the lack of fossil records. However, the little evidence available seems to indicate that all the modern-day species of the Ellipsoptera group evolved from a primitive form that reached North America from Eurasia via the Bering land bridge before the Tertiary Period. During the early to mid Tertiary, this unknown ancestral species evolved into several species, one of which occupied the Great Basin east of the Rocky Mountains and another which occupied the very large southeastern coastal plain of the continent. As the cooler, dried climate of the late Tertiary took affect, this southeast coastal ancestral species could have begun to differentiate into two species—one favoring coastal habitats and the other favoring riparian habitats. The riparian macra-like ancestral species probably gave rise to modern-day macra, cuprascens, and puritana. The coastal marginata-like ancestral species probably gave rise to marginata and hamata.

So, although marginata and hamata almost certainly originated from the same ancestral stock, it is apparent that the selective pressure for the coupling sulcus has not been equal. Since marginata has the more primitive coupling sulcus, it is probably the older species, or at least most like the ancestral form, and probably spent greater amounts of time evolving in the cooler, more northernly areas. In fact, it is possible that the modern-day occurrence of this species on the Florida peninsula, Keys, Cuba, and Bahamas could be due to expansion of populations during comparatively recent geological time (perhaps aided by the rising and falling sea level during Pleistocene glaciation). On the other hand, the more recently evolved hamata has succeeded in exploiting the warmer climates of the Gulf coast, thereby exerting greater selective pressure for a cavity-type coupling sulcus. This species has also undergone selection for habitat (substrate) matching (resulting

in subspeciation--another indication of its more modern status), the greatly expanded white maculation of hamata pallifera from the white beaches of the Yucatan Peninsula being the most outstanding example.

There are still many unanswered questions, but it is obvious that both marginata and hamata, despite their similarities in seasonality, ecology and behavior, are currently provided with a mechanism of reproductive isolation that prohibits interbreeding of populations along the western coast of Florida.

Literature Cited

Freitag, R. 1974. Selection for a non-genetalic mating structure in female tiger beetles of the genus Cicindela (Coleoptera: Cicindelidae). Can. Entomol. 106(6):561-568

The Collector's Jar

In Southeast Asia lives a bloodsucking moth Calyptra eustrigata (Noctuidae) that feeds on black rhinoceros, Indian elephant, water buffalo and more. It pierces skin with a barbed, straw-like proboscis.

The bolas spider Mastophora biasaccata from the southeastern United States does not spin a web to capture its food. Instead, it attracts male moths by placing a chemical droplet that imitates the sex pheromone (attractant) of the female moth on the end of a silk strand. The spider then swings this "ball and chain" in the air until some unlucky male moth approaches too closely in his search for a mate.

Daddy-long-legs are not spiders, but belong to a different order (group) of arachnids called Opiliones or harvestmen. Actually, many species have very short legs. If you grab a harvestman by the leg, it will often drop its appendage in your hand and escape using its remaining seven legs.

The silk moth Bombyx mori is completely dependent on people for its survival, so it may be considered the only truly domesticated insect. The ancient Chinese cultivated the silkworm before 4700 B.C.--during the late Stone Age! The larvae require one ton of mulberry leaves to produce enough silken cocoons for a mere pound of finished silk.

If you know an unusual fact about arthropods and would like to submit it, make sure you include name and page number of your source (book, journal, magazine).
on spiders and moths . . .

Reviews

NOVA: A Scientific Television Odyssey

In this day and age of television trash, it may be almost imposible to imagine that television can be an education, as well as entertaining, medium. At least one educational program provides great insight into a potpourri of current and timeless scientific topics, including several entomology related subjects. NOVA, produced by WGBH (Boston) can be seen on many stations of the United States' Public Broadcasting System. Without commercial advertising interruption, the viewer may explore the wonders of the spider world, travel to Africa to meet the tsetse fly, or gasp in amazement as a locust swarm glides across a radar screen. Dazzling photography, coupled with a penetrating, informative narration never fail to captivate television audiences. Each fascinating episode contains a wealth of information.

I have been so intrigued by some editions of NOVA that I have written for transcripts of the broadcasts. For only three dollars, I receive a priceless reference. Among the topics thus-far covered by NOVA, here are some of the entomological ones: "The Insect Alternative" (an eye-opening view of pest control); "Life on a Silken Thread" (a probing look at spiders); "Locusts: War Without End" (the horror of present day locust plagues); and "The Tsetse Fly" (you wouldn't believe what this fly can do!); "A Desert Place," "Still Waters" (on pond life), "Animal Imposters" (camouflage and mimicry), "Termites to Telescopes," and "The Rise and Fall of DDT" also contain information on insects and other arthropods.

Transcripts may be obtained from the WGBH Education Foundation, 125 Western Avenue, Boston, MA 02134 USA. NOVA: Adventures in Science is a recently published synopsis of excerpts from many broadcasts and is available in paperback at many bookstores ($14.95). However, the transcripts provide more in-depth coverage.

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"Life on a Little Known Planet"
$2.95
by Howard Ensign Evans, 1966,
Delle Publishing Co., New York. 304 pp.

Howard Evans is an authority on parasitic wasps, but that hasn't stopped him from writing this delightful book which covers many groups of insects. Life on a Little Known Planet is a different kind of insect book. It won't help the reader identify specimens, collect them or rear them. It isn't even very good as far as general information on insects.

So why is it so delightful? Evans has managed to take a close and scholarly look at several groups of insects, including some that are not usually considered particularly interesting. He has taken cockroaches, midges, bed bugs, and, of course, parasitic wasps, and explored the little known details of their lives. He makes these animals not only interesting, but fun.

As an example, Evans cites the "combat bed bug", a kind of cone nosed bug that was reputedly tested by the U.S. Army. It was meant to be an ambush detector due to its reaction to humans at some distance. In another section, he explains an ancient remedy for cockroach infestations." Hold a looking-glass to their faces and they will be so frightened as to quit the premises."

This is not to say that this book deals only with the humorous aspects of entomology. That would be selling it far short. Evans is also very good at explaining fairly complicated biological concepts in an easily understood manner. He delves into "hidden species" among crickets, the role of juvenile hormone in molting, light production in fireflies, and other similar subjects. Evans makes this material fun, which is refreshing in contrast to the dry way this material is often presented in text books.

The crowning achievement of this book is its last two chapters, "Of Springs, Silent an Otherwise," and "Is Nature Really Necessary?" This is a rare book because these two chapters serve to tie insects and entomologists into the bigger picture of our society and our environment. They give a good perspective on the importance of preserving our environment in light of the importance of controlling insects which affect human health, crops, etc. This is refreshing, because unlike many in the environmental movement, and many of their critics, he is a rational man who advocates that a balance be struck through compromise.

In short, if you're looking for a book that will give you the detailed life cycle of the brown-tail moth, keep looking. If, however, you are looking for an informative book full of the wonder and fun of insects, look no farther.

Life on a Little Known Planet was published some time ago, but seems to still be in many bookstores. Evans is also the author of Wasp Farm, 1962.

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"Life on a Little Known Planet"
by Howard Ensign Evans
1978, E. P. Hutton, New York. 293 pp.
(out of print)

On a poor collecting day the amateur entomologist will enjoy reading "In Defense of Magic: The Story of Fireflies", "The Cricket as Poet and Pubilist", or "Parasitic Wasps and How They Made Peyton Place Possible". These are only a sample of the 13 delightful chapters of Howard Esign Evans' Life on a Little-Known Planet. Evans has chosen additional groups such as springtails, flies, butterflies and locusts. The format of each capter includes structures, interesting life cycles, historical experiments and current news by consulting specialists and somewhat unexpected literary quotes, stories, and humorous commentary. Evans includes commentary chapters on nature and invites us to learn more about what is going on in our own backyards instead of outerspace. The book also provides notes on classification and further reading suggestions. Forty-three illustrations in the form of drawings are included to explain points in the text. One drawback would be lack of detailed information in the text. The greatest difficulty is finding a copy as the book is out of print, but can still be found in used book stores.

I found this book to be a fascinating learning experience. I would recommend it for anyone interested in learning more about the general field of entomology.

Cynthia Harnett
2748 E. 22nd Place
Tulsa, OK 74114

Trading Post

FOR SALE AND EXCHANGE: World-wide Lepidoptera and Coleoptera. Send large stamped envelope (40¢) for free lists. Also, will buy scarce or rare specimens. John Holden, Jr., P.O. Box 188, Garwin, IA 50632 USA.

WANTED: Many species of pests of humans and other animals--mites, ticks, lice, fleas, small scorpions, etc. Purchase or exchange. Richard F. Wilkey, Arthropod Slidemounts, P.O. Box 185, Bluffton, IN 46714 USA.

WANTED: Would like to trade Montana Lepidoptera for Lepidoptera of other parts of the world. Specimens must be in good condition and with full data (date of capture, location, etc.). Would be willing to trade or buy. Send name of species available and description (wing span, color, etc.) to Craig Odegard, 73855 Beryl Lane, Missoula, MT 59801 USA. All letters answered!

WANTED: Information on the availability of a checklist of all species of butterflies and skippers of the world. Willing to buy. Any information welcome, please write: Craig Odegard. 7385 Beryl Lane, Missoula, MT 59801 USA.

EXCHANGE: I will collect what you want from my area in exchange for Diptera, especially Bombyliidae, Dolichopodidae, Asilidae, and Tabanidae. Michael L. Bourandes, 725 Orange Ave., #6, Long Beach, CA 90813 USA.

FREE PUBLICATION: Reprints of "A Directory of Policies on Arthropod Collecting On Public Lands." This publication covers all the rules and regulations concerning the collection of terrestrial and aquatic arthropods from all government-related (state, federal, and territorial) lands in the United States. It is complete with the addresses of officials to contact for permission to collect or for permits. Send requests to: Gary A. Dunn, Dept. of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA.

TIEG PUBLICATIONS: We still have a supply of back issues of TIEG Magazine (10(1)-May '75; 11(2)-Fall '77; 12(1)-Spr. '78; 12(2)-Fall '78 and 13(1)-Summer '81) and TIEG News (most issues) if you would like to complete your set. Make contributions of 50¢ per issue payable to Michigan State University.

Trading Post (continued)

EXCHANGE: Would like to exchange specimens of Cicindelidae and Carabidae with persons outside of Michigan or the U.S. Can offer many North American species. Interested in all species of the world--regardless of size or abundance. Write: Gary A. Dunn, Dept. of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA.

Y.E.S. CONTEST

Y.E.S. is not just our name--it's also a statement of our positive "can do" attitude toward the future of our organization. We can do it, and here's a way that you can get involved and help. We need a logo (emblem) for our group's publications and publicity materials. And, we want YOU to design the logo. Thus, I'm pleased to announce a logo design contest open to all interested persons.

The rules are simple: (1) this is a "free style" competition--any size, shape, design, or format will be considered (HOWEVER, keep the following in mind: the design should be reproduceable in black and white and should be scaled to allow reduction without substantial loss of detail; in other words, keep it straight and simple but cleverly designed.); (2) all designs should be submitted to Y.E.S. (c/o Dept. of Entomology, Michigan State University, East Lansing, MI 48824-1115 USA) no later than June 15, 1984. (Be sure to include your name and address along with the entry.)

The winning design will be unveiled in the Summer issue of Y.E.S. QUARTERLY. The winner will receive a complimentary 5 years membership in the Y.E.S. plus a handsome award certificate.

So, send in your entry today. Don't worry if you're not an artist--rough sketches are perfectly acceptable. Remember, this is a design contest--not an art contest. We are interested in your concepts and ideas.

Y.E.S. NEEDS YOU

With the publication of this Spring issue of Y.E.S. QUARTERLY we have nearly exhausted our backlog of manuscripts. Send us your articles and other materials for publication in the summer and future issues. (See the "Instructions for Authors" on the inside front cover of this issue.) Materials for the summer issue should be received by June 30, 1984; materials arriving after this date will be used in the fall issue.

See you next time . . . and Good Luck with your collecting!

Gary A. Dunn

Extension Entomologist
Y.E.S. Advisor